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| EXAMINER |
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MCCRACKEN, DANIEL

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| ART UNIT | PAPER NUMBER |
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1754

| SHORTENED STATUTORY PERIOD OF RESPONSE | MAIL DATE | DELIVERY MODE |
|--|------------|---------------|
| 3 MONTHS | 04/06/2007 | PAPER |

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

| | | | |
|------------------------------|--|--------------------------------------|--|
| Office Action Summary | Application No. 10/500,798 | Applicant(s) IIJIMA ET AL. | |
| | Examiner Daniel C. McCracken | Art Unit 1754 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-14 is/are rejected.
- 7) ☒ Claim(s) 1 and 2 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. ____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date ____ | 6) <input type="checkbox"/> Other: ____ |

DETAILED ACTION

Citation to the Specification will be in the following format (S. #, ¶) where # denotes the page number and ¶ denotes the paragraph number. Citation to patent literature will be in the form (Inventor #, LL) where # is the column number and LL is the line number.

Drawings

New corrected drawings in compliance with 37 CFR 1.121(d) are required in this application because the current "Figs. 5-6" are unintelligible. It is unclear what the drawings are conveying and does not appear to be of acceptable quality for printing.. Applicant is advised to employ the services of a competent patent draftsman outside the Office, as the U.S. Patent and Trademark Office no longer prepares new drawings. The corrected drawings are required in reply to the Office action to avoid abandonment of the application. The requirement for corrected drawings will not be held in abeyance.

Information Disclosure Statement

The information disclosure statement filed 07/07/2004 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; each non-patent literature publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered.

No references were found, and accordingly, the references mentioned on the IDS were not considered.

Claim Objections

Claims 1-2 are objected to because of the following informalities: In Claims 1-2, it would appear as if "the" should have been inserted before "overall." In Claims 1-2, a space

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should be inserted in between “therebetween [sic].” In Claim 2, “nanosheres [sic] is misspelled. Generally speaking, it appears as if the application was not proofread after the machine translation and preliminary amendment. *Applicants are strongly encouraged to review the entire application for spelling and grammar errors.* Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-6 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter that was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The claims contain structural limitations that are not supported by the specification. While Applicants' spectroscopy data would support a graphite sphere, there is no evidence that Applicants have produced graphite spheres comprising “pyramids” that meet at an apex as claimed. A claim of such a structure is speculative given the disclosure. Reference was made to the TEM images that would better lend support to the sphere having graphitic faces, however this feature is not shown in the images provided. *See* (S. 9, 3) (“It was confirmed from Figs. 5 and 6 that there are a number of graphite faces on the surface of the graphite nanoshperes.”)

Claims 1-3 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. It is generally recognized by one of ordinary skill in the art that there is space between the layers of graphite. Claims 1 and 2 recite no space between the layers. This rejection may be obviated by a satisfactory showing by way of 37 C.F.R. 1.132 affidavit that the Raman spectroscopy data provided actually discloses graphite with no space between the layers. The Examiner is of the opinion that no such thing exists. *See* Duward Shriver & Peter Atkins, *Inorganic Chemistry*, 352 (3d ed. W.H. Freeman and Company 1999) (“On the other hand, graphite consists of stacks of planar layers within which each C atom has three nearest-neighbors at 1.42 Å (Fig. 10.17).”).

Claims 10-14 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The analysis for determining whether a claim is supported by the disclosure is cast in terms of whether “undue experimentation” is necessary to practice the invention. *See* MPEP 2164.01. In examining the claims in light of the supporting disclosure, the Federal Circuit has provided a non-exclusive list of factors to consider in determining whether a disclosure is enabling. *See generally In re Wands*, 858 F.2d 731, 737, 8 USPQ2d 1400, 1404 (Fed. Cir. 1988). These factors include:

- a. The breadth of the claims;

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- b. The nature of the invention;
- c. The state of the prior art;
- d. The level of one of ordinary skill;
- e. The level of predictability in the art;
- f. The amount of direction provided by the inventor;
- g. The existence of working examples; and
- h. The quantity of experimentation needed to make or use the invention based on the content of the disclosure

Id. “Whether undue experimentation is needed is not a single, simple factual determination, but rather is a conclusion reached by weighing many factual considerations.” *Id.* Examiner has considered all factors in light of all claims rejected makes the following findings of fact:

a. The breadth of the claims

Generally speaking, the claims when viewed in light of the specification are worded broadly to include arguably any “peculiarly shaped” graphite nanosphere.

b. The nature of the invention

The invention relates to graphite nanospheres, their properties and a method for their preparation.

c. The state of the prior art and the level of one of ordinary skill

Presumably one of ordinary skill in the art would be familiar with carbon nanotechnology, specifically the preparation and synthesis of various fullerene compounds. It would seem reasonable to assume the references cited are indicative of ordinary skill in the art.

d. The level of predictability in the art

The focus of this enablement rejection relates to “peeling” graphite layers. The Examiner is adopting a reasonable construction of peeling to mean “the removal of a single layer,” much like one would peel the rind of an orange. If the Examiner would adopt Applicants

definition of a graphite nanosphere (*see* enablement rejection of Claims 1-3), this would presumably be exceedingly difficult – that is, peeling a layer the thickness of a carbon atom from a sphere where there is no space between the layers. Even with Examiners reference showing an inter-layer distance of 1.42 angstroms, this would be exceedingly difficult.

The Examiner recognizes that there are various mechanical treatments that can be performed on graphite particles and fullerene molecules (*e.g.* ball milling), but these processes necessarily crush the molecule as opposed to peeling layers from them.

e. The amount of direction provided by the inventor

Generally speaking, parallelism exists between the claims as drafted and the disclosure in the specification. The direction provided by Applicants however is lacking. Applicants make the assertion in their Specification that it is possible to “peel[] about half of the pyramid formed graphite layer.” (S. 7, 4). At the largest claimed outer diameter of 1000 nm (which necessarily yields a radius of 500 nm), and assuming a perfectly spherical graphite nanosphere, the surface area of the nanosphere could be calculated as follows:

$$A = 4\pi R^2 \text{ (surface area of a sphere)}$$

$$A = 4(3.14)(500 \text{ nm})^2$$

$$A = 3,140,000 \text{ nm}^2$$

Half of this figure gives, 1,570,000 nm² or 1.57 x 10⁻¹² m. Assuming *arguendo* that this was possible, Applicants have not shown that they can or have even measured this.

f. The existence of working examples

No working examples were provided. All that is reasonably clear is that Applicants pointed a laser at a pile of carbon, and ended up with whatever is shown (or not shown) in Fig. 3-6.

g. The quantity of experimentation needed to make or use the invention based on the content of the disclosure

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Given the fact that Applicants have not demonstrated experimental proof of this feature of their claimed invention, arguably infinite - certainly undue - experimentation is necessary to practice the invention.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-6 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The term "almost" in claims 1-2 and 4-6 is a relative term that renders the claim indefinite. The term "almost" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. While applicants provide some scant guidance at (S. 5, 4), the passage at the top of page 6 would seem to indicate that "almost spherical" could include "almost ellipsoidal, semi-spherical and *peculiarly shaped* graphite nanospheres." (S. 6, 1) (emphasis added). Further, with respect to Claim 2, it is unclear how a nanosphere can have no spaces between layers, yet appear hollow. As to Claim 6, it is unclear and indefinite as to where to place the abscissa on an "almost spherical surface" to measure the claimed angles.

The claims are generally narrative and indefinite, failing to conform with current U.S. practice. They appear to be a literal translation into English from a foreign document and are replete with grammatical and idiomatic errors.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-6 are rejected under 35 U.S.C. 102(b) as being anticipated by M. Terrones, et al., *Graphitic Structures: From Planar to Spheres, Toroids and Helices*, 354 Phil. Trans. R. Soc. Lond. A 2025 (1996).

With respect to Claims 1-6, Terrones discloses spherical graphitic nanospheres. *See* (Terrones at 2026-2027) *and* (Terrones “Fig. 1b-1c”). As to Claim 3, the spheres are nano-scaled. *Id.* Notwithstanding the 35 USC §112 issues *supra*, it would appear as if the nanospheres described by Terrones necessarily disclose the structural features claimed. *Compare e.g.* (Terrones at 2027 “Fig. 1”) *with* (S. “Fig. 2”). “[T]he PTO can require an applicant to prove that the prior art products do not necessarily or inherently possess the characteristics of his [or her] claimed product. Whether the rejection is based on inherency’ under 35 U.S.C. 102, on prima facie obviousness’ under 35 U.S.C. 103, jointly or alternatively, the burden of proof is the same...[footnote omitted].” The burden of proof is similar to that required with respect to product-by-process claims. *In re Fitzgerald*, 619 F.2d 67, 70, 205 USPQ 594, 596 (CCPA 1980) (quoting *In re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433-34 (CCPA 1977)).

Claims 1-6 are rejected under 35 U.S.C. 102(b) as being anticipated by D. Ugarte, *Onion-like Graphitic Particles*, 33 Carbon 989 (1995).

With respect to Claims 1-6, Ugarte discloses spherical graphitic nanospheres. *See generally* (Ugarte at 989 “2. Synthesis of multi-shell fullerenes”). Notwithstanding the 35 USC

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§112 issues *supra*, it would appear as if the nanospheres described by Ugarte necessarily disclose the structural features claimed. *Compare e.g.* (Ugarte at 990 “Fig. 1”) *with* (S. “Fig. 2”). “[T]he PTO can require an applicant to prove that the prior art products do not necessarily or inherently possess the characteristics of his [or her] claimed product. Whether the rejection is based on inherency’ under 35 U.S.C. 102, on prima facie obviousness’ under 35 U.S.C. 103, jointly or alternatively, the burden of proof is the same...[footnote omitted].” The burden of proof is similar to that required with respect to product-by-process claims. *In re Fitzgerald*, 619 F.2d 67, 70, 205 USPQ 594, 596 (CCPA 1980) (quoting *In re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433-34 (CCPA 1977)).

Claims 1-6 are rejected under 35 U.S.C. 102(e) as being anticipated by US 6692718 B1 to Osawa.

With respect to Claims 1-6, Osawa discloses spherical graphitic nanospheres. *See* (Osawa 5, 48-67) *and* (Osawa “Figs. 1-2”). Notwithstanding the 35 USC §112 issues *supra*, it would appear as if the nanospheres described by Osawa necessarily disclose the structural features claimed. *Compare e.g.* (Osawa “Fig. 2”) *with* (S. “Fig. 2”). “[T]he PTO can require an applicant to prove that the prior art products do not necessarily or inherently possess the characteristics of his [or her] claimed product. Whether the rejection is based on inherency’ under 35 U.S.C. 102, on prima facie obviousness’ under 35 U.S.C. 103, jointly or alternatively, the burden of proof is the same...[footnote omitted].” The burden of proof is similar to that required with respect to product-by-process claims. *In re Fitzgerald*, 619 F.2d 67, 70, 205 USPQ 594, 596 (CCPA 1980) (quoting *In re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433-34 (CCPA 1977)).

Claims 1-6 are rejected under 35 U.S.C. 102(b) as being anticipated by M.Stroh, *Serendipity yields buckyball trap for gases*, 141 Science News 356 (1992).

While *substantial ambiguity* exists as to what Applicants are actually trying to claim with their product claims, Stroh is offered because the figure depicted in Stroh bears a striking resemblance to as much of Applicants Fig. 6 as the Examiner can make out. "[T]he PTO can require an applicant to prove that the prior art products do not necessarily or inherently possess the characteristics of his [or her] claimed product. Whether the rejection is based on inherency' under 35 U.S.C. 102, on prima facie obviousness' under 35 U.S.C. 103, jointly or alternatively, the burden of proof is the same...[footnote omitted]." The burden of proof is similar to that required with respect to product-by-process claims. In re Fitzgerald, 619 F.2d 67, 70, 205 USPQ 594, 596 (CCPA 1980) (quoting In re Best, 562 F.2d 1252, 1255, 195 USPQ 430, 433-34 (CCPA 1977)).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 7-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over C. Journet, et al., *Production of carbon nanotubes*, 67 Appl. Phys. A 1 (1998) in view of Shunji Bandow, *Purification of Single-Wall Carbon Nanotubes by Microfiltration*, 101 J. Phys. Chem. B 8839 (1997).

With respect to Claims 7-8, Journet discloses a method including the steps of laser ablation of a graphite target in an inert gas at a temperature above 1000 °C. *See generally* (Journet at 3 “2 Laser Ablation”). Journet generally directs the discussion towards carbon nanotubes, that is, it does not disclose *in haec verba* “graphite nanospheres.” Bandow however discloses that a laser ablation process necessarily produces the graphite nanospheres of the claimed invention. *Compare* (Bandow at 8839, Col. 1) (“In both the laser vaporization and electric arc methods for SWNT production, *a considerable (or even dominant) fraction of the carbon generated is in the form of sp^2 -bonded carbon nanospheres (CNS).*”) (citation omitted, emphasis added) *with* (S. 6, 4) (“The chemical bond may be a bond between sp^2 six-membered rings.”).

As to the pressure and gas limitations found in Claims 7-9, Journet discloses "This is not surprising since the experimental conditions depend on various parameters such as the metal concentration [5-24], *the inert-gas pressure, the nature of the gas* [25], the current, and the geometry of the system." (Journet at 3, Col 1.) (emphasis added). Further, Journet states "all the techniques described in this report reflect the current state of the art and still need to be optimized." (Journet at 1, Col. 1). To the extent Journet does not explicitly recite the claimed pressure limitation, "discovery of an optimum value of a result effective variable in a known process is ordinarily within the skill of the art." *In re Boesch*, 205 USPQ 215, 219 (CCPA 1980) (citations omitted).

Conclusion


All remarks and amendments made in addressing this office action must be accompanied by a pinpoint citation (i.e. page and paragraph number) to the specification to indicate where Applicants are drawing their support.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel C. McCracken whose telephone number is (571) 272-6537. The examiner can normally be reached on Monday through Friday, 9 AM - 6 PM EST.

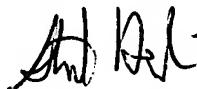
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley S. Silverman can be reached on (571) 272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



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